REMARKS

Claims 1, 3, 7-9, 15, 19 and 26 were pending in this application.

Applicants have amended Claims 3 and 26.

Accordingly, Claims 1, 3, 7-9, 15, 19 and 26 remain pending.

Applicants turn now to the claim objections and rejections under 35 U.S.C. §§ 112, 102 and 103.

Section 112 Rejections

Claims 3, 15 and 26 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for the reasons set forth at page 2 of the Action.

Applicants' claim amendments address and remedy the Section 112 rejections.

Accordingly, Applicants request that this claim rejection be reconsidered and withdrawn.

Section 103 Rejections

Claims 1, 3, 7-9, 15, 19, and 26 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over:

U.S. Patent Application No. 5,863,493 (Achari et al.)("the '493 patent") in view of 5,538,686 (Chen et al.) ("the '686 patent").

Applicants traverse these Section 103 rejections.

The '493 patent, cited as a primary reference, is directed to and claims an electrical solder composition consisting essentially of between 91.5-96.5% Sn; 2-5% Ag; 0-2% Cu; and 0.1-2% Ni and having a melting temperature 220°C or less. Sn-Ni, Sn-Cu, and Sn-Cu-Ni alloys have a uniformly dispersed microstructure leading to intermetallic formation. Such intermetallic formation is reported to increase resistance to temperature cycling.

Absent from the '493 patent as required components are Sb and Bi, appearing to be optional at concentrations of up to 1%, and Cu too is only mentioned as an optional element. In an effort to remedy the deficiencies of the '493 patent as a reference for citation under Section 103, the Action turns to the '686 patent.

The '686 patent is directed to an article comprising a solder composition, the solder composition comprising an alloy having at least approximately 70 percent tin, approximately 6-10 weight percent zinc, approximately 3-10 weight percent indium, and an effective amount of bismuth not greater than

approximately 10 weight percent to reduce the tendency for the formation of lower temperature phases. Sb is mentioned as a possible alternative additional element. Thus, distilled to its essence, the '686 patent discloses a Sn-Zn-In alloy, with Bi and/or possibly Sb.

In contrast, the inventive lead free soldering material as defined for instance with reference to Claim 1 includes the combination of six elements, which in combination improves temperature cycling and improves hardening.

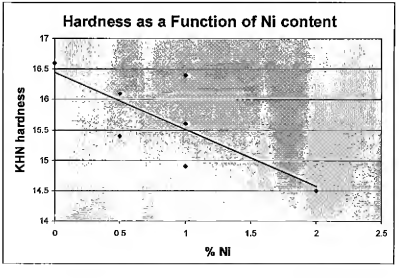
Two different types of alloys are disclosed in the '493 patent and the '686 patent. Given the '493 patent, one of ordinary skill in the art would not look to a Sn-Zn alloy (such as disclosed in the '686 patent) because that alloy contains different metallurgy and is more reactive, requiring different fluxing systems.

Looking to the '686 patent to supply the missing elements of the Examiner's obviousness formula, ignores salient and required teachings of '686 patent -- i.e, the presence of Zn, more particularly at a significant level (6-10 weight percent).

The '686 patent refers to the addition of Sb and/or Bi to a Sn-Zn-In solder alloy to reduce the tendency of low melting temperature phases to form. Solders based on Sn-Zn-In have a

different metallurgy than Sn-Ag-Cu solders, and there is no reason to expect that based on the '493 patent the addition of Bi and Sb would have the same result.

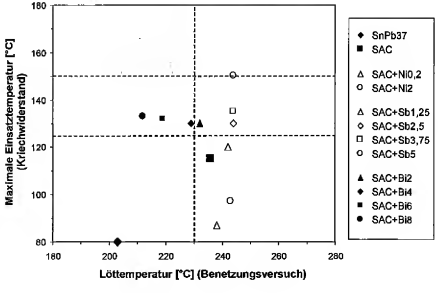
The '493 patent covers the addition of 0.1-2% Ni to Sn-Ag-Cu alloys to improve mechanical properties, reporting that dispersed Sn-Ni and Sn-Ni-Cu intermetallics inhibit grain growth, and increase creep resistance, and hence 'fatigue strength'. However, no creep, fatigue or even tensile or shear strength measurements were reported in the '493 patent. Rather, the only mechanical property reportedly tested was hardness. Interestingly, the hardness measurements of the '493 patent show a reduction in hardness with the Ni addition, as depicted in the table below, contradicting the claim of increased creep resistance.



The effect on creep resistance at elevated temperatures by the addition of Ni, Sb and Bi, individually and

in combination, to a base Sn-Ag-Cu alloy (specifically, SnAg3.8Cu0.7), are of interest because in combination they represent the substance of the invention as defined by the pending claims.

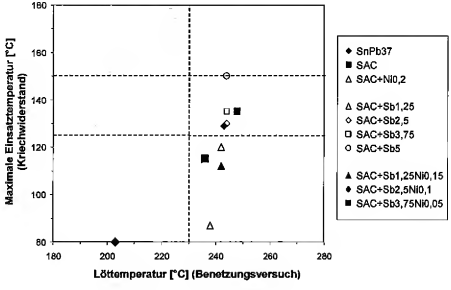
In the table below, the Y axis shows maximum operating temperature, which is proportional to elevated temperature creep strength. The X axis shows soldering temperature, which depends on melting point. The target is a combination of a soldering temperature ≤230°C and an operating temperature ≥150°C, represented by the top left hand rectangle.



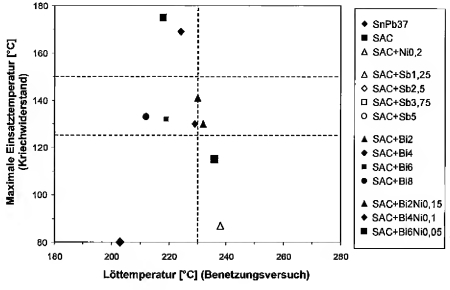
The addition of Ni significantly reduced creep resistance, contrary to what the '493 patent would suggest.

Thus, the addition of Ni to the Sn-Ag-Cu alloy as proposed by the '493 patent has a negative effect.

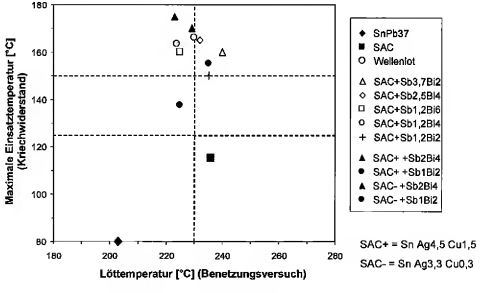
In the table below, the addition of Sb and Ni in combination to the Sn-Ag-Cu alloy gave poorer results than the addition of Sb, again illustrating the negative effect of the addition of only the Ni to a Sn-Ag-Cu alloy.



In the table below, the addition of Bi and Ni in combination to a Sn-Ag-Cu alloy, had a significant increase in elevated temperature creep strength.

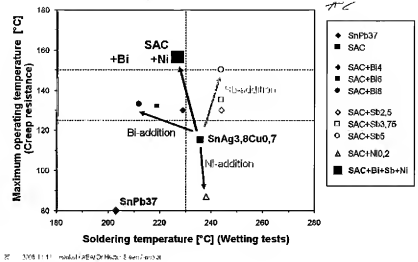


In the table below, the addition Bi and Sb in combination to a Sn-Ag-Cu alloy showed the beneficial effects of the individual elements.



In the table below, the addition of Sb, Bi and Ni to a Sn-Ag-Cu alloy created a six component alloy that allowed for the beneficial effects to be achieved without observation of Bi

precipitation at grain boundaries and formation of low melting phases that would reduce reliability in fatigue under temperature cycling.



In sum, neither the '493 patent nor the '686 patent, individually or in combination, impacts adversely the claims as presently presented in the subject patent application.

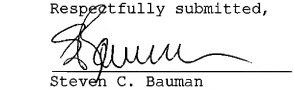
The '493 patent actually proposes a Sn-Ag-Cu alloy with the addition of Ni that is inferior in mechanical properties to the base Sn-Ag-Cu alloy. The '686 patent uses a completely different base alloy system, Sn-Zn-In, where the claimed benefit of Bi addition is for the opposite effect of the Bi addition to the Sn-Ag-Cu alloy.

Based on the above, favorable reconsideration and consideration as the case may be is respectfully requested.

Having addressed and overcome each of the rejections advanced in the Action, prompt and favorable re-consideration of the subject application is respectfully requested.

Applicants' undersigned attorney may be reached by telephone at (860) 571-5001, by facsimile at (860) 571-5028 or by email at steve.bauman@us.henkel.com. All correspondence should be directed to the address given below.

Respectfully submitted,



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